Ilmu Pertanian (Agricultural Science)
Vol. 2 No. 3 December, 2017 : 112-118
Available online at http://journal.ugm.ac.id/jip
DOI: doi.org/10.22146/ipas.30098

ILMU PERTANIAN
(AGRICULTURAL SCIENCE)

The Effects of Filter Cake and Bagasse Ash to Growth and NPK Uptake by Sugarcane (*Saccharum Officinarum* L.) at Ultisols in Tulang Bawang, Lampung, Indonesia

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Received: 8th November 2017 ; Revised: 23rd November 2017 ; Accepted: 29th December 2017

ABSTRACT

The available soils for surgarcane plantation is Ultisols. However, the Ultisols has some limitations on its chemical fertility. Efforts to improve the quality of the soil can be done with applying organic matter such as filter cake and bagasse ash resulting from the process of making sugar from sugarcane. This study was proposed to determine the effects of bagasse ash and filter cake to availabilities of NPK in the soil and NPK uptakes by sugarcane, so that they were expected to be able to improve maximum sugarcane growth in Ultisols in Tulang Bawang. This field research used completely randomized design with two factors. The first factor was the bagasse ash doses in four levels: without bagasse ash (A_0), 10 ton/ha of dry bagasse ash (A_1), 20 ton/ha of dry bagasse ash (A_2), and 40 ton/ha of dry bagasse ash (A_3). The second factor was the filter cake doses in four levels: without filter cake (B_0), 20 ton/ha of dry filter cake (B_1), 40 ton/ha of dry filter cake (B_2), and 80 ton/ha of dry filter cake (B_3). There were a total of 16 combinations of treatment with 3 blocks as repetitions. Data were analyzed by using F-test with 5% significance. When analysis result showed significant differences between treatments, it was then followed by DMR test with 5% significance level for normal data. The results showed that the improvement of NPK status of Ultisols in Lampung might be achieved by applying the filter cake and bagasse ash techniques. Some results of this study showed that treatment of 40 ton/ha bagasse ash for NPK uptakes was significantly different and higher than without bagasse ash treatment. Treatment of 80 ton/ha filter cake for NPK uptakes was significantly different and higher than without filter cake treatment. The highest N uptake (27.84 kg/ha) was in sugarcane at 2 MAP with 80 ton/ha filter cake treatment. The highest P uptake (11.59 kg/ha) was in sugarcane at 2 MAP with 40 ton/ha bagasse ash treatment. The highest K uptake (117.67 kg/ha) was in sugarcane at 8 MAP with 80 ton/ha filter cake treatment. Treatment of 80 ton/ha filter cake influenced significantly to the sugarcane height compared to without filter cake and 20 ton/ha filter cake treatment, but it did not differ significantly compared to 40 ton/ha filter cake treatment. The highest sugarcane (167.99 cm) was at 80 ton/ha filter cake treatment. Filter cake dose treatments did not influence significantly the numbers of saplings and stem diameter of sugarcane aged 8 MAP.

Keywords: Bagasse Ash, Filter Cake, NPK Fertilizer, Ultisols

INTRODUCTION

Sugar is one of basic needs for most of people and it is a relative cheap calorie source. Sugar consumption is increasing annually and it provides a wide opportunity for sugar production improvement. One of efforts to increase national sugar production is by enhancing sugarcane plantation land (extensification). Flat land availability for sugarcane is decreasing annually because there are land competitions for other commodities, and converting of sugarcane fields into housing and industries. Therefore, the sugarcane plantation areas are enhanced to dry sloping land which approximately constitutes 47% of total of land width in Indonesia. This is possible because most of land areas in Indonesia are located in mountains (>30%) and hills (15-30%) with 51.3 million ha and 36.9 million ha respectively (Dariah and Las, 2010). The main soil type in the dry land is ultisol with 54.7 million ha in width. For sugarcane culture, the ultisol soil has problems with erosion because the surface layer is easy to be compacted by any loading pressure which causes infiltration progress to be slow, low alkaline saturation (less than 35% of standard of 8.2

pH), and low weathering mineral level, so that this soil type is chemically poor. In addition, the ultisol also has problems with high acidity, high exchangeable Al, low ion exchange capacity (IEC) (less than 24 me per 100 gram of soil), low soil N, P, and K contents (Munir, 1996).

Soil qualities influence the sugarcane productivity. To improve soil quality, organic materials can be added to the soil such as filter cake and bagasse ash produced as by products in the sugar making process from sugarcane. Filter cake as by product from sugarcane processing is in solid form and containing water and it still has fairly high temperature. Its form is like soil, but it is the sugarcane fiber mixed with dirt which is separated from its sweet juice. Besides filter cake, there is bagasse ash from factory kettle. The yield of bagasse ash is approximately 0.3% from the sugarcane weight and it has high silicate content of approximately 70%. The objective of this research was to find out the effects of bagasse ash and filter cake to availabilities of soil NPK and NPK uptakes by sugarcane, so that they were expected to be able to improve maximum sugarcane growth in ultisol soil in Tulang Bawang.

MATERIALS AND METHODS

This research was conducted from July 2016 to March 2017 in PT Sweet Indolampung plantation field, Tulang Bawang Regency, Lampung Province. TC-15 variety of sugarcane germ, bagasse ash and filter cake from factory waste of PT Sweet Indolampung, urea, ZA, SP36, and KCl were used for this research. Equipments used were tractors and implements to cultivate land, tools for soil analysis, stationeries, stopwatch, roll meter scale, and oven.

This research used completely randomized design with two factors. The first factor was the bagasse ash doses in four levels: without bagasse ash (A_0), 10 ton/ha of dry bagasse ash (A_1), 20 ton/ha of dry bagasse ash (A_2), and 40 ton/ha of dry bagasse ash (A_3). The second factor was the filter cake doses in four levels: without filter cake (B_0), 20 ton/ha of dry filter cake (B_1), 40 ton/ha of dry filter cake (B_2), and 80 ton/ha of dry filter cake (B_3). There were a total of 16 combinations of treatment with 3 blocks as repetitions.

The observed variables included pH H_2O and KCl, organic matter, C-organic, N-total, P-available, K-available, and CEC in the soil (initial and end of the research), then plant height, number of saplings, and stem diameter of sugarcane at ages 2 and 8 MAP. Data were analyzed by using F-test with 5% significance. When analysis result showed significant differences between treatments, it was then followed by DMR test with 5% significance level for normal data. Correlation analysis was to find out the extent of correlation between observed variables. The analysis on soil nutrient uptake efficiency showed relative balances between soil nutrients to absorb and to use by the sugarcane and numbers of loss nutrients.

RESULT AND DISCUSSION

Initial Soil Physical and Chemical Properties

Table 1 showed that sand is the dominant soil fraction (64%). The pH of H2O in the soil was acid (5.4). High soil temperature causes C-organic is easy to decay, especially with intensive land processing in the sugarcane culture it causes C-organic in soil to be very low approximately 0.88%. According to Munir (1996), decaying level and ultisol soil formation run faster. This causes lower alkaline density about 28%. In addition, ultisol also has low cation exchange capacity (9.78 cmol (+)/kg), low nitrogen content (0.1%), low magnesium and potassium (0.74% and 0.10%), and very low calcium and sodium contents (1.87% and 0.05%). P-availability is very high at approximately 26 mg/100g.

Baggase Ash and Filter Cake

All materials that improve soil contain water, ash mineral, and organic compounds. Ash minerals in the bagasse ash are 2.76% (Table 2) which include N, P, K, Ca, and Mg which are able to improve NPK contents in the soil. This is beneficial in improving sugarcane productivity.

Bagasse ash is a residue produced by bagasse burning in the sugar factory. Bagasse ash can be reused because it contains inorganic minerals or other metal elements which are nutrients required by plants (Purwati et.al, 2007). According to Misran (2005), bagasse ash waste can be mixed with other substances to form into a mixed fertilizer (fine compost).

The dominant chemical compound in bagasse ash is 58.40% SiO_2 (silica). Sugarcane is one of commodities which accumulate Si, a plant which uptakes Si more than water (Thiagalingam *et al*., 1977). According to Meena *et al*., (2014), during one year growth, sugarcane uptakes about 300-700 kg/ha of Si. This sum is varying in sugarcane leafs, from very low (0.14%) in young leafs up to very high (6.7%) in older leafs. High silica content to take in each harvest causes poor silica content in the soil and in turn it causes reduced plant productivity. The more sugarcane

Table 1. Soil physical and chemical properties in 0-20 cm depth

Parameter	Value	Level*
Texture		Sandy loam clay
Sand (%)	64	
Ash (%)	9	
Clay (%)	27	
pH		
pH H_2O	5.4	Acid
pH KCl	4.8	
Organic material (%)	1.52	Moderate
C-organic (%)	0.88	Very low
N-total (%)	0.10	Low
C/N ratio	9	Low
Extract of HCl 25%		
P_2O_5 total (mg/100g)	26	Very high
K_2O (mg/100g)	5	Very low
Extract of Bray I		
P_2O_5 (ppm)	48.7	Very high
KTK (cmol (+)/kg)	9.74	Low
KB (%)	28	Low
Extract of NH_4^-Acetat 1N, pH 7		
Ca (cmol (+)/kg)	1.87	Very low
Mg (cmol (+)/kg)	0.74	Low
K (cmol (+)/kg)	0.10	Low
Na (cmol (+)/kg)	0.05	Very low

Remarks: *Criteria based on Soil Research Office (2005)

Table 2. Bagasse ash and filter cake chemical properties

Parameter	Bagasse Ash	Filter Cake
Water content	37.62	77.19
pH	6.50	6.50
Organic materials	8.91	16.86
C-organic	5.17	9.78
Total N	1.40	0.84
C/N Ratio	4.00	12.00
Total P_2O_5	0.22	0.90
Total K_2O	0.61	0.13
Total Ca	0.32	1.20
Total Mg	0.21	0.17
Rough silicate	58.40	-

is cycled with ratoon (2-3 times of harvesting and then replanted), then the more silica content will be depleted in the soil if it is conducted without any efforts to return back soil silica content accurately and effectively.

Filter cake is widely used for materials in making compost fertilizer (Misran, 2005). The filter cake to use in this research contains total of 13.02% of C-organic, N, P_2O_5, K_2O, Ca, and Mg. These soil nutrient contents can be used directly by sugarcane in its growth. According to Sutanto (2005), C/N <20 causes microorganism death and this means a simpler nutrient element decomposition.

Soil Chemical Properties

The analysis of variance (Table 3) shows that treatment of adding bagasse ash 40 ton/ha has significant different contents in pH H_2O, pH KCl, C-organic, organic materials, and cation exchange capability compared to without bagasse ash addition treatment. The treatment of filter cake 80 ton/ha has significant different contents in pH H_2O, pH KCl, C-organic, organic materials, and cation exchange capability compared to without filter cake addition treatment. In 80 ton/ha filter cake addition treatment, there were increases of C-organic, soil organic material, and soil cation exchange capability of 79%, 78%, and 25% respectively. Filter cake contains of very high organic materials which are energy sources for soil microorganism activities to produce soil nutrients. Soil nutrients are charged colloids with cation exchange capability of 200-500 me%, so that filter cake addition with proper doses will increase soil cation exchange capability (Sutanto, 2005).

Highest actual acidity level increase (pH H_2O) and potential acidity level (pH KCl) occurred in 40 ton/ha bagasse ash addition treatment (A_3). This A_3 treatment increased pH H_2O (16%) and pH KCl (11%) compared to without bagasse ash addition treatment (A_0). Bagasse ash addition with dominant Si content causes pH H_2O increases. According to Keeping *et al.*, (2015), the Si effect to ultisol is through reaction from $2NH_4^+$ and H^+ protons in soil solution with the following chemical reaction:

$NH_4^+ + 2O_2^- \rightarrow 2H^+ + NO_3^- + H_2O$..................(1)

$2H^+ + Ca_2SiO_4 \rightarrow H_4SiO_4 + 2Ca_2^+$....................(2)

According to Hayes (2014), in ultisol the active sesquioxide Al and Fe contents are abundant so that it absorbs $H_3SiO_4^-$ until it is not available for the plant. This is also useful to improve soil pH KCl.

The highest C-organic (30%) occurred at 40 ton/ha bagasse ash addition treatment and 79% in 80 ton/ha filter cake addition treatment compared to without bagasse ash and filter cake treatments. This is because bagasse ash and filter cake contain high enough C-organic and more doses will increase C-organic content into the soil (Table 3). The improvement content of organic materials also occur along with

Table 3. Soil chemical properties in varying bagasse ash and filter cake treatments to sugarcane at 8 months after planting (MAP)

Treatments	pH H_2O	pH KCl	C-Organic (%)	Organic Materials (%)	CEC (cmol (+)/kg)
Bagasse ash doses (A):					
Without bagasse ash	5.6 a	5.2 a	1.58 a	2.73 a	18.57 a
Bagasse ash 10 ton/ha	6.4 b	5.8 b	1.77 b	3.05 b	20.11 b
Bagasse ash 20 ton/ha	6.2 c	6.1 b	1.89 b	3.26 b	20.17 b
Bagasse ash 40 ton/ha	6.5 c	5.8 b	2.06 c	3.55 c	21.27 c
Filter cake doses (B):					
Without filter cake	6.0 a	5.5 a	1.32 a	2.28 a	17.97a
Filter cake 20 ton/ha	6.1 b	5.5 a	1.63 b	2.82 b	19.17b
Filter cake 40 ton/ha	6.3 bc	6.0 ab	1.99 c	3.43 c	20.40 c
Filter cake 80 ton/ha	6.4 c	5.8 b	2.36 d	4.06 d	22.59 d
Interaction	(-)	(-)	(-)	(-)	(-)

Remarks: Numbers in a column followed by the same letter was not different significantly, (-) shows no interaction according to DMRT with 5% significance level.

Table 4. Soil NPK availabilities in varying bagasse ash and filter cake doses in sugarcane at 2 and 8 MAP

Treatments	N-Total (%)		P-Available (ppm)		K-Available (cmol (+)/kg)	
	2 MAP	8 MAP	2 MAP	8 MAP	2 MAP	8 MAP
Bagasse ash doses (A):						
Without bagasse ash	0.17 a	0.16 a	17.0 ab	9.3 a	0.28 a	0.35 a
Bagasse ash 10 ton/ha	0.20 b	0.17 b	15.4 a	11.2 b	0.31 b	0.37 a
Bagasse ash 20 ton/ha	0.23 c	0.20 b	17.1 ab	12.1 c	0.38 c	0.42 b
Bagasse ash 40 ton/ha	0.23 c	0.23 b	17.8 b	13.1 d	0.44 d	0.42 b
Filter cake doses (B):						
Without filter cake	0.18 a	0.16 a	14.6 a	7.5 a	0.25a	0.33 a
Filter cake 20 ton/ha	0.20 b	0.18 a	16.6 b	10.5 b	0.32 b	0.34 a
Filter cake 40 ton/ha	0.22 c	0.20 ab	17.8 b	12.6 c	0.39 c	0.42 b
Filter cake 80 ton/ha	0.23 d	0.23 b	18.3 b	15.2 d	0.46 d	0.45 b
Interaction	(-)	(-)	(-)	(-)	(-)	(-)

Remarks: Numbers in a column followed by the same letter was not different significantly, (-) shows no interaction according to DMRT with 5% significance level.

dose increases of bagasse ash and filter cake administered into the soil.

Soil NPK Nutrient Availabilities

The results of analysis of variance (Table 4) show that 40 ton/ha bagasse ash addition treatment has significant different contents for total-N, available P, available K compared to without bagasse ash addition treatment. Available P of sugarcane at 2 months after planting (MAP) does not differ significantly compared to without treatment 80 ton/ha filter cake addition treatment produces significant differences of total-N, available P, and available K compared to without treatment. The highest total-N (43%) is found in sugarcane at 8 MAP with 40 ton/ha bagasse ash and 80 ton/ha filter cake addition treatments. The highest available P increase (40%) occurs in sugarcane at 8 MAP with 40 ton/ha bagasse ash treatment and 102% with 80 ton/ha filter cake addition treatment.

Available P increase by bagasse ash is influenced by the monosilicic acid contained in the bagasse ash. The monosilicic acid consentration increase in the soil will produce transformation from undissolved P into available P for the plant. Unavailable phosphor for the plant is because it is in embedded form. SiO_4^{4-} has bigger electronegativity compared to $PO4^{3-}$, so that SiO_4^{4-} can substitute embedded PO_4^{3-}. The second process is that Si can bind P so that P leaching is reduced to approximately 40-90% (Matichenkov and Calvert, 2002).

The highest available K content (0.44

Table 5. NPK uptakes by sugarcane in varying bagasse ash and filter cake doses at 2 and 8 MAP

Treatments	N uptake (kg/ha)		P uptake (kg/ha)		K uptake (kg/ha)	
	2 MAP	8 MAP	2 MAP	8 MAP	2 MAP	8 MAP
Bagasse ash doses (A):						
Without bagasse ash	21.75 a	107.74 a	8.90 a	43.14 a	21.03 a	86.55 a
Bagasse ash 10 ton/ha	25.45 a	109.96 ab	11.09 b	46.00 ab	22.23 a	96.79 a
Bagasse ash 20 ton/ha	23.89 a	125.96 b	11.63 b	51.97 b	21.15 a	97.00 a
Bagasse ash 40 ton/ha	25.99 a	116.96 ab	11.59 b	47.13 ab	22.30 a	101.58 a
Filter cake doses (B):						
Without filter cake	20.92 a	107.52 a	9.73 a	43.23 ab	18.46 a	79.07 a
Filter cake 20 ton/ha	21.77 a	103.67 a	10.22 ab	41.82 a	19.26 a	82.69 a
Filter cake 40 ton/ha	26.55 b	120.77 ab	11.15 ab	49.84 bc	23.51 b	102.49 b
Filter cake 80 ton/ha	27.84 b	128.67 b	12.11 b	53.35 c	24.86 b	117.67 c
Interaction	(-)	(-)	(-)	(-)	(-)	(-)

Remarks: Numbers in a column followed by the same letter was not different significantly, (-) shows no interaction according to DMRT with 5% significance level.

Table 6. NPK uptake efficiency by sugarcane at varying bagasse ash and filter cake treatments at 2 and 8 MAP

Treatments	N Uptake Efficiency (%)		P Uptake Efficiency (%)		K Uptake Efficiency (%)	
	2 MAP	8 MAP	2 MAP	8 MAP	2 MAP	8 MAP
Bagasse ash doses (A):						
Without bagasse ash	3.94 a	6.96 a	3.93 a	6.96 a	4.56 a	7.66 a
Bagasse ash 10 ton/ha	6.70 a	13.15 ab	6.69 ab	13.14 ab	7.47 c	17.59 b
Bagasse ash 20 ton/ha	5.31 b	18.40 b	5.31 ab	18.40 b	5.56 ab	15.40 ab
Bagasse ash 40 ton/ha	7.61 b	20.31 b	7.60 c	20.30 b	6.32 bc	24.74 b
Filter cake doses (B):						
Without filter cake	3.98 a	9.36 a	3.98 a	9.36 a	3.99 a	5.06 a
Filter cake 20 ton/ha	4.12 ab	6.34 a	4.12 a	6.33 a	4.22 a	7.90 a
Filter cake 40 ton/ha	7.04 ab	16.92 ab	7.03 a	16.91 ab	7.17 b	19.02 b
Filter cake 80 ton/ha	8.41 b	26.21 a	8.41 a	26.20 b	8.52 b	33.42 c
Interaction	(-)	(-)	(-)	(-)	(-)	(-)

Remarks: Numbers in a column followed by the same letter was not different significantly, (-) shows no interaction according to DMRT with 5% significance level.

cmol(+)/kg) occurs in sugarcane at 2 MAP with 40 ton/ha bagasse ash addition treatment or it increase 57% compared to without treatment and 0.46 cmol(+)/kg with 80 ton/ha filter cake addition treatment or it increases 84% compared to without treatment. Mukherjee (2014) recommends 50 ton/ha filter cake application. Soil P and K availabilities improves with that dose.

NPK Uptakes

The analysis of variance results (Table 5) show that 40 ton/ha bagasse ash addition treatment produces significant differences of N, P, and K uptakes compared to without bagasse ash treatment. However, the sugarcane P uptake at 8 months after planting (MAP) with 40 ton/ha bagasse ash addition treatment does not influence significantly compared to without treatment. According to Mukherjee (2014), phosphate in bagasse ash has a big level of solubility equals to TSP, so that it can be used by the plant.

80 ton/ha filter cake treatment has N, P, and K uptakes which differ significantly compared to without filter cake treatment. However, 80 ton/ha filter cake addition treatment does not influence significantly compared to without bagasse ash treatment for sugarcane N uptake content at 8 MAP.

The highest N uptake (27.84 kg/ha) occurs in sugarcane at 2 MAP with 80 ton/ha filter cake addition treatment or it increases 33% compared to without filter cake treatment. The highest P uptake (11.59 kg/ha) occurs in sugarcane at 2 MAP with 40 ton/ha bagasse ash addition treatment or it increase 30% compared to without bagasse ash treatment. Gardner

Table 7. Sugarcane growth at 8 MAP with varying bagasse ash and filter cake treatments

Treatment	Plant height (cm)	Number of sapling	Stem diameter (mm)
Bagasse ash doses (A):			
Without bagasse ash	164.48 a	2.25 a	20.96 a
Bagasse ash 10 ton/ha	166.97 a	2.38 a	21.04 a
Bagasse ash 20 ton/ha	160.99 a	2.39 a	21.00 a
Bagasse ash 40 ton/ha	159.12 a	2.15 a	21.09 a
Filter cake doses (B):			
Without filter cake	159.89 a	2.41 a	20.93 ab
Filter cake 20 ton/ha	159.20 a	2.13 b	21.09 ab
Filter cake 40 ton/ha	164.48 ab	2.26 ab	21.23 a
Filter cake 80 ton/ha	167.99 b	2.38 ab	20.84 b
Interaction	(-)	(-)	(-)

Remarks: Numbers in a column followed by the same letter was not different significantly, (-) shows no interaction according to DMRT with 5% significance level.

et al., (1985) found that the higher P concentrations in medium can improve P uptake and harvest yield and it improves root length, root fineness, and root density. The highest K uptake (117.67 kg/ha) was in sugarcane at 8 MAP with 80 ton/ha filter cake addition treatment or it increases 48% compared to without filter cake treatment.

NPK Uptakes Efficiency

The root CEC influences the NPK uptakes and this varies depending on species, varieties, and ages. Elements contained in young root mucigels can exchange the elements which are electrostatically bound in soil particles, in a process of contact exchange. Once entering the root, the ions can move actively in simplasma or passively in apoplasma, while the passive movement is faster so that uptakes will be more (Gardner *et al*., 1985).

The analysis of variance results (Table 6) show that 40 ton/ha bagasse ash addition treatment and 80 ton/ha filter cake addition treatment have significant difference of N, P, and K uptake efficiency compared to without bagasse ash and filter cake treatments.

The highest N uptake (20.31%) and P uptake (20.30%) are in sugarcane at 8 MAP with 40 ton/ha bagasse ash addition treatment, or it increase 191% compared to without treatment. 80 ton/ha filter cake addition treatment influence significantly the K uptake efficiency in sugarcane at 8 MAP with efficiency improvement of 560% compared to without filter cake treatment. Sugarcane characteristic of K uptake exceeds the sufficiency zone. Fertilizing up to exceeding zone is economically not productive (Gardner *et al*., 1985).

Sugarcane Growth

The analysis of variance results (Table 7) show that all bagasse ash treatments do not influence significantly the sugarcane heights, numbers of saplings, and stem diameters.

80 ton/ha filter cake addition treatment influences significantly the sugarcane heights compared to without treatment and 20 ton/ha filter cake addition treatment does not influence significantly compared to 40 ton/ha bagasse ash addition dose. The highest sugarcane height increase (167.99 cm) occur in 80 ton/ha or it increase 5% compared to without filter cake treatment. Filter cake significantly increases N, P, and K uptakes. The N uptake increase interacts to K uptake increase. Potassium has an important role in photosynthesis because it directly increases growth and leaf width index (Gardner *et al*., 1985). All filter cake addition treatments do not influence significantly the number of saplings and stem diameter. K uptake improvement can also improve number of supporting roots and stem parenchyma.

CONCLUSIONS

Treatment of 40 ton/ha bagasse ash for NPK uptakes value was significantly different and higher than without bagasse ash treatment. Treatment of 80 ton ha^{-1} filter cake for NPK uptakes value was also significantly different and higher than without filter cake treatment. The highest N uptake was (27.84 kg ha^{-1}) in sugarcane at 2 MAP with 80 ton/ha filter cake treatment , it increased 33% compared to without filter cake treatment. The highest P uptake was (11.59 kg ha^{-1}) in sugarcane at 2 MAP with 40 ton ha^{-1} bagasse ash treatment . The highest K uptake was (117.67 kg ha^{-1}) in sugarcane at 8 MAP with 80 ton/ha filter cake treatment . Treatment of 80 ton ha^{-1} filter cake influenced significantly the sugarcane height compared to without treatment, but 20 ton ha^{-1} filter cake treatment was not different significantly compared to 40 ton ha^{-1} filter cake treatment. The highest sugarcane was (167.99 cm) in sugarcane with 80 ton ha^{-1} filter cake treatment. Filter cake dose treatments did not influence significantly the number of saplings and stem diameters of sugarcane aged 8 MAP.

ACKNOWLEDGEMENT

The author would like to express the gratitude to Dr. Purwaty Lee Cauhoult as the vice president director of Sugar Group Companies. The author would also like to thank the employee and staff of PT. Sweet Indolampung which has helped and facilitated the author in conducting his research thesis.

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